# A Taxonomic Revision of the Japanese Species of the Genus Pselaphogenius (Coleoptera, Staphylinidae, Pselaphinae) Part 2, Pselaphogenius paradoxus

By

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野村 周平\*:日本産アラメヒゲナガアリヅカムシ属(コウチュウ目,ハネカクシ科,アリヅカムシ亜科)の分類学的再検討.第2部 サイゴクヒゲナガアリヅカムシ (和名新称)

A Pselaphine genus *Pselaphogenius* is notably diversified in western Japan and striking geographical variation is recognized in some species on the male genital structure. As the second part of this study, I treated a widely distributed species, *P. paradoxus* K. Sawada and its geographical variation.

Pselaphogenius paradoxus K. Sawada was described from Kyoto and Ôsaka Prefectures. I found that this species is widely distributed in the western part of Japan and shows a remarkable geographical variation. The separately described species, P. magnioculatus K. Sawada from Akiyoshidai, Yamaguchi Pref., is considered in the present study to be a geographical variant of this species. As the result, this species is classified into four subspecies, P. paradoxus magnioculatus K. Sawada, stat. nov., P. p. iyonis subsp. nov., P. p. chiyokoae subsp. nov., and the nominotypical subspecies.

## Pselaphogenius paradoxus K. SAWADA

[Japanese name: Saigoku-higenaga-arizukamushi]

Pselaphogenius paradoxus K. Sawada, 1969, Kontyû, Tokyo, 37: 1–19; Nomura, 1989, Check List Jpn. Ins., Fukuoka, 1: 292; Besuchet, 1999, Revue suisse Zool., 106: 62.

Male. Body reddish brown to dark brown, maxillary palpi and tarsi light brown, elongate, narrowed anteriorly.

Head longer than wide, clypeus very short, invisible in dorsal view, frons strongly convex, narrowed and weakly constricted just behind antennal bases, with a short notch at apex, and with a shallow and broad median groove from the apical notch to dorsal tentorial pits, vertex slightly convex, with a shallow depression along median line, densely covered with weak reticulate microsculpture, postgenae broad and gently rounded. Eyes small and convex, each ovoid, consisting of 7 to 9 facets. Antennae reaching base of elytra, slender, 1st segment large, longer than wide, subcylindrical, 2nd short, subcylindrical, 3rd to 8th subequal, each slightly longer than wide, weakly thickened distad, 9th to 10th large, each ovoid, 11th the largest, about as long as 9th+10th, longer than wide and ovoid. Maxillary palpi very long and very slen-

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der, 1st segment short and slender, arcuately bent, 2nd long, very slender in basal 3/4, thickened near apex, 3rd short and thick, triangular in dorsal view, 4th the largest, about as long as 1st+2nd+3rd, very slender in median part, weakly thickened near base, thickened and ovoid in apical 1/4, with a small and shallow depression and 2 short setae at apex.

Pronotum about as long as wide, round-sided, with a pair of small lateral foveae at basal 2/5, covered with shallow reticulate microsculpture on dorsal surface. Elytra wider than long, almost triangular, narrowed anteriorly, covered with shallow reticulate microsculpture on dorsal surface, each elytron with 2 basal foveae and a weak longitudinal carina between the basal foveae, densely covered with bold setae along its posterior margin. Legs short and slender.

Abdomen very large, larger than elytra, 4th segment predominantly large, slightly broadened posteriad, 4th tergite transverse and rectangular, with a pair of large paratergites, 5th to 6th segment subequal in dorsal length, each very short, 7th longer than 6th, transverse and trapezoidal, 8th tergite transverse and trapezoidal, 8th sternite semicircular, flattened on ventral side.

Male genitalia (Figs. 1, 2, 3A-C) well sclerotized and distinctly asymmetrical; parameres large and lamellar, right paramere simply rounded at apex, left paramere longer than the right, with 3 to 9 long and bold ctenidia near apex; median lobe thickened and rounded in basal part, more or less narrowed in apical part, with a round membranous part on basi-dorsal side, apical orifice on left side of the apex, a long ventral process on ventral side, and an apical and a subapical spines on right side near apex; endophallus well sclerotized, various in shape.

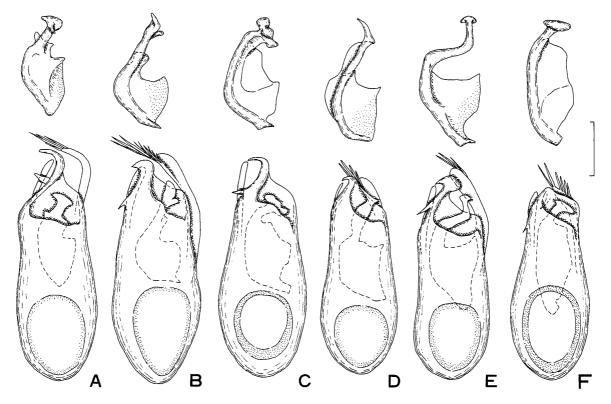


Fig. 1. Male genitalia (above: endophallus; below: median lobe and parameres in dorsal view) of *Pselaphogenius paradoxus* subspp. A: *P. p. paradoxus* K. Sawada from Mt. Hieizan, Shiga Pref.; B: *P. p. magnioculatus* K. Sawada from Mt. Mimuroyama, Hyôgo Pref.; C: ditto, from Dankyô, Dougo Is., Oki Isls., Shimane Pref.; D: ditto, from Mt. Hibasan, Hiroshima Pref., E: ditto, from Kamagari-chô, Hiroshima Pref.; F: ditto, from Mt. Kurusonzan, Yamaguchi Pref. Scale: 0.1 mm.

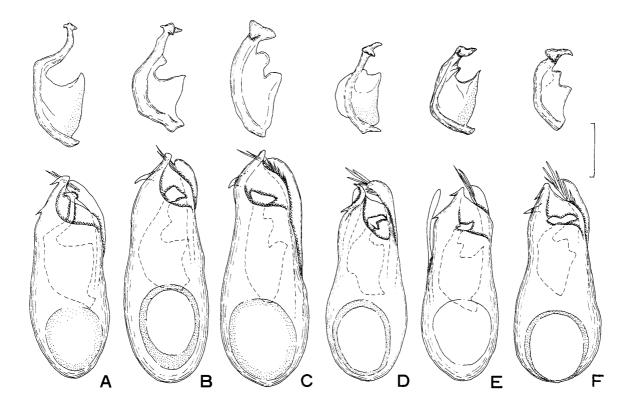


Fig. 2. Male genitalia (above: endophallus; below: median lobe and parameres in dorsal view) of *Pselaphogenius paradoxus magnioculatus* K. SAWADA. A: male from Mt. Takanawasan, Ehime Pref.; B: male from Mt. Fukuchiyama, Fukuoka Pref.; C: male from Mt. Futagoyama, Kunisaki Peninsula, Ôita Pref.; D: male from Tsukushi-Yabakei Vall., Fukuoka Pref.; E: male from Kikuchi Vall., Kumamoto Pref.; F: male from Mt. Sobosan, Ôita Pref. Scale: 0.1 mm.

Female. Very similar to male in external structure. Ninth abdominal sternite (Fig. 3D-E) composed of apical lobe and basal sclerite; apical lobe large and transverse, including a pair of lateral and a median sclerites, lateral sclerites each narrow, connected with median sclerite in its apical part, median sclerite elongate and gently broadened apicad, with a pair of longitudinal carinae on internal side; basal sclerite more sclerotized than in apical lobe, transverse, with a pair of long and broad basal arms on its lateral parts. Genital plate small and well sclerotized, nearly trapezoidal in posterior view, composed of a median and a pair of lateral walls.

Distribution. Western Honshu including the Oki Isls., Shikoku, Kyushu.

Remarks. This species is closely allied to *P. patrius* Nomura in having the left paramere bearing ctenidia, apical orifice on the left side of the apex, and the apical and subapical spines on the apical part of the median lobe. It is, however, easily distinguished from *P. patrius* by having the more or less narrowed apex of the median lobe (almost truncate in *P. patrius*), and the apical spine at the apex of the median lobe (on the ventral side and invisible in dorsal view in *P. patrius*).

## A Key to the Subspecies of P. paradoxus K. SAWADA

- 2. Median lobe with a long, slender and arcuate apical spine at apex, and a small subapical spine pointing

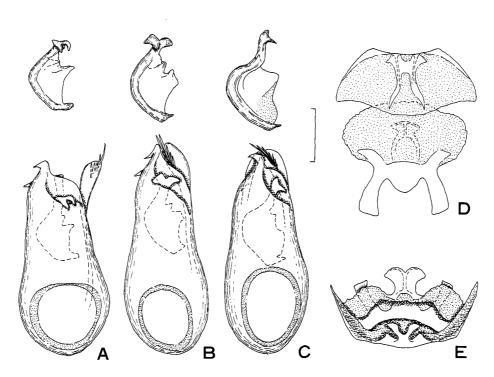


Fig. 3. A-C: Pselaphogenius paradoxus magnioculatus K. Sawada, male genitalia (above: endophallus; below: median lobe and parameres in dorsal view). A: male from Mt. Shiragadake, Kumamoto Pref.; B: male from Mt. Shibisan, Kagoshima Pref.; C: male from Sosanji, Miyazaki Pref. D: P. p. magnioculatus from Mt. Hikosan, Fukuoka Pref., female 9th abdominal sternite and genital plate in ventral view; E: ditto, in posterior view. Scale: 0.1 mm.

## Pselaphogenius paradoxus paradoxus K. SAWADA

Male. Length 1.61 mm. Width 0.66 mm. Male genitalia (Fig. 1A) medium-sized, weakly sclerotized; parameres very slender, right paramere simply rounded at apex, left paramere slightly broadened near apex, with 4–5 very long ctenidia at apex; median lobe strongly narrowed in apical 1/4, with long and slender apical spine at apex, a small subapical spine at right side of the base of apical spine, the apical spine arcuately curved rightwards, the subapical spine pointing rightwards and slightly apicad; endophallus broadened and lamellar in basal part, apical part constricted near apex, projected dorsally at apex.

Female. Length 1.58-1.59 mm. Width 0.69 mm.

Specimens examined. 1 male, 2 females, Mt. Hieizan, Shiga Pref., 9. xi. 1993, Y. Sawada leg.; 1 male, Kasuga shrine, Sasayama-chô, Hyôgo Pref., 30. iv. 1984, Y. Hayashi leg.; 1 male, Mt. Ameishiyama,

Sasayama-chô, Hyôgo Pref., 24. v. 1986, Y. HAYASHI leg.

Distribution. Honshu (Kinki district).

Remarks. The nominotypical subspecies is originally recorded from Kibune and Mt. Hiei, Kyoto Prefecture and Minoo, Ôsaka Prefecture. It is characterized by the long, slender and arcuate apical spine and the subapical spine pointing rightwards and slightly apicad on the median lobe.

## Pselaphogenius paradoxus magnioculatus K. SAWADA, stat. nov.

Pselaphogenius magnioculatus K. Sawada, 1971, Bull. Akiyoshi-dai Sci. Mus., (7): 75–91; Nomura, 1989, Check List Jpn. Ins., Fukuoka, 1: 292; Besuchet, 1999, Revue suisse Zool., 106: 61.

Male. Length 1.43–1.58 mm. Width 0.60–0.65 mm. Male genitalia (Figs. 1B-F, 2, 3A-C) similar to that of the nominotypical subspecies, but differs in the following features: left paramere more or less broadened near apex, rounded at apex in general, with 3 to 8 long ctenidia near apex; median lobe less narrowed in apical part than in the nominotypical subspecies, apical spine short and hook-like in many cases, subapical spine very small, pointing rightwards and more or less basally; endophallus variable geographically in shape.

Female. Length 1.45-1.60 mm. Width 0.60-0.70 mm.

Geographical variation. The typical form described by K. Sawada (1971) is collected at Akiyoshidai and Mt. Kurusonzan, Yamaguchi Pref. It is characterized by the dull apex of the median lobe and the endophallus bearing broadened and dorsally projected apical part and well broadened basal part (Fig. 1F). In the populations of Mt. Mimuroyama, Hyôgo Pref. (Fig. 1B), Mt. Hibasan, Hiroshima Pref. (Fig. 1D), and Matsue City, Shimane Pref., the endophallus is distinct in having the slender and apically sharpened apical part. In that of Dougo Is., Oki Isls. (Fig. 1C), the apical part of the endophallus is broadened and hammerhead-like. In those of Kamagari-cho, Hiroshima Pref. (Fig. 1E) and Mt. Takanawasan, Ehime Pref. (Fig. 2A), the median lobe is slightly broadened and hook-like at the apex, and the endophallus is slender and reverse S-shaped in dorsal view bearing slightly broadened apical part. In the Kyushu populations (Figs. 2B, 2D-F, 3A-C) (except for that of the Kunisaki Peninsula), the endophallus is relatively short and the apical part is well projected and less broadened at apex than in the typical form and the other subspecies, and it bears two or three processes at the apex. In the population of Mt. Futagoyama, Kunisaki Peninsula, Ôita Pref. (Fig. 2C), the endophallus is similar to that of the typical form of Mt. Kurusonzan and subsp. *iyonis* from Shikoku, but it is doubtless classified in this subspecies in view of the peculiarity of the left paramere.

Specimens examined. <Honshu> 1 male, Mt. Mimuroyama, Chikusa-chô, Hyôgo Pref., 11. v. 1997, H. Hoshina leg.; 1 male, Dankyô, Tsuma-mura, Dougo Is., Oki Isls., Shimane Pref., 1. xi. 1986, H. Kaneko leg.; 1 male, Mt. Makuragiyama, Makuragi-chô, Matsue City, Shimane Pref., 3. x. 1986, S. Fukui leg.; 1 male, Mt. Hibasan, 1,150m alt., Saijô-chô, Hiroshima Pref., 10. xi. 1998, S. Nomura leg.; 1 male, Kamagari-chô, Hiroshima Pref., 7. xi. 1987, I. Okamoto leg.; 1 male, 1 female, Mt. Kurusonzan, 420–490m alt., Toyota-chô, Yamaguchi Pref., 12. xi. 1998, S. Nomura leg. <Shikoku> 1 male, Mt. Takanawasan, Hôjô City, Ehime Pref., 1. i. 1993, N. Tsurusaki leg. <Kyushu> 11 males, 8 females, Mt. Fukuchiyama, Nôgata City, Fukuoka Pref., 21. iv. 1985, S. Nomura leg.; 3 males, 1 female, same locality as above, 23. x. 1995, H. Hoshina leg.; 2 males, 5 females, same locality as above, 30. x. 1995, H. Hoshina leg.; 2 males, same locality as above, 13. xi. 1995, H. Hoshina leg.; 1 male, 1 female, same locality as above, 27. xi. 1995, H. Hoshina leg.; 1 male, 4 female, same locality as above, 4. xii. 1995, H. Hoshina leg.; 3 males, 6 females, same locality as above, 8. iv. 1997, H. Hoshina leg.; 1 male, Kanezaki, Genkai-machi, Fukuoka Pref., 6. ix. 1983, H.

HARADA leg.; 2 males, 4 females, Chikuzen-Ôshima Is., Ôshima-mura, Fukuoka Pref., 25. i. 1993, H. KOJIMA leg.; 1 male, Mt. Tachibanayama, Fukuoka City, Fukuoka Pref., 24. v. 1984, S. Nomura leg.; 2 males, 1 female, Tsukushi-Yabakei Vall., Nakagawa-machi, Fukuoka Pref., 16. iii. 1986, S. Nomura leg.; 1 male, 2 females, Mt. Koshosan, Amagi City, Fukuoka Pref., 23. x. 1988, S. Nomura leg.; 1 male, Hoshino, Fukuoka Pref., 17. xi. 1981, S. Tanaka leg.; 1 male, Mt. Hikosan, 1,200m alt., 15. iv. 1970, H. Makihara leg.; 1 female, Mt. Hikosan, Soeda-machi, Fukuoka Pref., 21. v. 1986, S. Nomura leg.; 8 males, 4 females, Pk. Nakadake, 1,200m alt., Mt. Hikosan, Soeda-machi, Fukuoka Pref., 13. x. 1992, S. Nomura leg.; 1 male, Buzenbô, Mt. Hikosan, Soeda-machi, Fukuoka Pref., 2. v. 1983, S. Nomura leg.; 1 male, 2 females, same locality as above, 27. viii. 1988, S. Nomura leg; 1 male, 2 females, same locality as above, 13. x. 1992, S. Nomura leg.; 9 males, 10 females, Kabutoyama Hill, Mt. Kôrasan, Kurume City, Fukuoka Pref., 19. xi. 1996, S. Nomura leg.; 4 males, 9 females, Kôra-Taisha Shrine, Mt. Kôrasan, Kurume City, Fukuoka Pref., 19. xi. 1996, S. Nomura leg.; 1 male, Fudô-iwa, Yamaga City, Kumamoto Pref., 19. xi. 1996, S. Nomura leg.; 1 male, Kikuchi Vall., 650m alt., Kikuchi City, Kumamoto Pref., 17. v. 1997, S. Nomura leg.; 1 male, 1 female, Mt. Shiragadake, Kami-mura, Kumamoto Pref., 21. iii. 1994, S. Onoda leg.; 4 males, 6 females, Mt. Kurodake, Shônai-chô, Öita Pref., 16. iv. 1985, S. Nomura leg.; 10 males, 5 females, same locality as above, 29. iv. 1985, S. Nomura leg.; 1 male, 2 females, same locality as above, 28. v. 1986, S. Nomura leg.; 1 female, Daisen-rindô, Kujû Mts., Ôita Pref., 5. vi. 1983, S. Nomura leg.; 1 male, Bohgatsuru, Kujû Mts., Ôita Pref., 23. v. 1994, H. Kojima leg.; 1 male, 2 females, Mt. Sobosan, Ôita Pref., 23. vii. 1983, S. Nomura leg.; 2 males, 1 female, 9-gôme, 1,700m alt., Mt. Sobosan, Ôita Pref., 16. v. 1986, S. Nomura leg.; 3 males, 2 females, Mt. Futagoyama, Kunisaki Peninsula, Ôita Pref., 7. xii. 1997, S. Nomura leg.; 1 male, Mt. Shiraiwasan, Gokase-chô, Miyazaki Pref., 30. iv. 1991, A. NAGAI leg.; 1 male, Mt. Ôkueyama, Kitagawachô, Miyazaki Pref., 8. x. 1984, S. Nomura leg.; 1 male, Shiiya Pass, Shiiba-son, Miyazaki Pref., 25. vi. 1994, S. Nomura leg.; 1 male, Mt. Morotsukayama, Morotsuka-son, Miyazaki Pref., 10. ix. 1994, S. Nomura leg.; 1 male, Sosanji, Miyazaki City, Miyazaki Pref., 9. ii. 1994, S. Nomura leg.; 3 males, 7 females, Mt. Shibisan, Miyanojô-chô, Kagoshima Pref., 25. iv. 1993, S. Onoda leg.; 2 males, 5 females, same locality as above, 1. vi. 1996, S. Onoda leg.

Distribution. Honshu (Chûgoku district), Shikoku, Kyushu.

Remarks. This subspecies is similar to the nominotypical subspecies in the apical part of the median lobe bearing two spines on the right side and the left paramere with long ctenidia. It is, however distinguished by the basally pointing subapical spine of the median lobe, and the broadened apical part of the left paramere.

## Pselaphogenius paradoxus iyonis subsp. nov.

Male. Length 1.51–1.60 mm. Width 0.65–0.69 mm. Male genitalia (Fig. 4A-B) very similar to those in the other subspecies in general structure; left paramere weakly broadened distad, with two groups of ctenidia near apex; median lobe large-sized, strongly narrowed near apex, with small apical spine at apex and very small subapical spine on ventral side; endophallus large, basal part well broadened, with two processes on left side in dorsal view, apical part strongly broadened near apex, hammerhead-like in dorsal view.

Female. Unknown.

Holotype, ♂ (preserved in National Science Museum, Tokyo), Namagusadani, Mt. Odamiyama, Odachô, Ehime Pref., 1. vi. 1996, E. Yамамото leg. Paratypes. 1 male, Mt. Saragamine, ca. 1,000m alt., Ehime Pref., 3. v. 1989, M. Sakai leg.

Distribution. Shikoku.

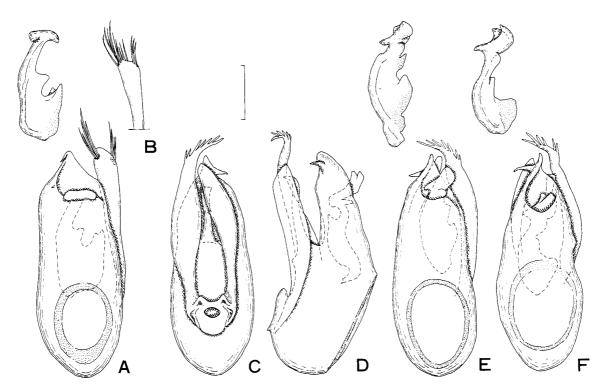


Fig. 4. A: Pselaphogenius paradoxus iyonis subsp. nov. from Mt. Odamiyama, Ehime Pref., endophallus (above), median lobe and parameres (below); B: ditto, from Mt. Saragamine, Ehime Pref., distal part of left paramere. C: P. p. chiyokoae subsp. nov. from Mt. Sefurisan, Saga Pref., male genitalia in ventral view; D: ditto, in lateral view; E: ditto, in dorsal view; F: ditto, from Mt. Kanayama, Fukuoka Pref., male genitalia in ventral view. Scale: 0.1 mm.

*Remarks*. This new subspecies is distinct in having the distally broadened left paramere bearing two groups of ctenidia.

*Etymology*. The specific name is associated with the old name of Ehime Prefecture, "Iyo", in which all the type specimens were collected.

## Pselaphogenius paradoxus chiyokoae subsp. nov.

Male. Length 1.53–1.59 mm. Width 0.64–0.68 mm. Male genitalia (Fig. 4C-F) similar to those of the other subspecies in general structure; left paramere longer than the right, gently broadened at median part, then narrowed distally, with a row of 6–7 ctenidia on external side of its apical part; median lobe weakly narrowed in apical part, sharpened at apex in dorsal view, apical spine indistinct, subapical spine small and sharpened, pointing rightwards and slightly basad; endophallus large and elongate, apical part more broadened than in magnioculatus from the other part of Fukuoka Prefecture.

Female. Length 1.53-1.58 mm. Width 0.64-0.66 mm.

Holotype, ♂ (preserved in National Science Museum, Tokyo), 1 male, Mt. Sefurisan 1,000m alt., Sefurimura, Saga Pref., 9. x. 1994, S. Nomura leg. Paratypes. 2 males, 1 female, same data as holotype; 1 male, 1 female, same locality as above, 27. xi. 1994, S. Nomura leg.; 1 male, same locality as holotype, 7. vi. 1994, S. Imasaka leg.; 1 male, Mt. Sefurisan, Nakagawa-machi, Fukuoka Pref., 16. vi. 1993, S. Onoda leg.; 5 males, 5 females, Mt. Kanayama, Fukuoka City, Fukuoka Pref., 9. iv. 1985, S. Nomura leg.

Distribution. Northern Kyushu (Sefuri Hills).

Remarks. This new subspecies is distinctly separated from magnioculatus by having the distally narrowed left paramere bearing a row of ctenidia on the external side of its apical part and the more broadened apical part of the endophallus. It is found from the western part of the Sefuri Hills on the borders of Saga and Fukuoka Prefectures, though the subsp. magnioculatus is collected at the eastern part of the hill range.

Etymology. This species is dedicated to the late Dr. Chiyoko Okuma (1931–1996), who was an eminent arachnidologist and my senior colleague in Kyushu University.

#### **Biogeographical Notes**

The distributional range of *Pselaphogenius paradoxus* K. Sawada shown in Fig. 5 is relatively wide as compared with those of the other member of the genus. It appearently overlaps those of the other *Pselaphogenius* species, that is in Kinki district, *P. paradoxus* and *P. spinifer spinifer* K. Sawada were found at the same locality (Minoo, Ôsaka Pref.) according to the original description by K. Sawada. In most parts of Chugoku district, the distributional range of *P. paradoxus* overlaps that of *P. dentipenis* K. Sawada described from Mt. Daisen, Tottori Prefecture, and its allied species or subspecies. In Shikoku, it is distributed together with the other undescribed species on Takanawasan Hill, and with four species on Odamiyama Hill. The overlapping of the distributional ranges of *P. paradoxus* and the other species is also recognized in some parts of middle to southern Kyushu, for instance, the Sobosan-Ohkue mountains and Mt. Shibisan.

On the other hand, a geographical variation at the subspecies level is recognized in the present study.

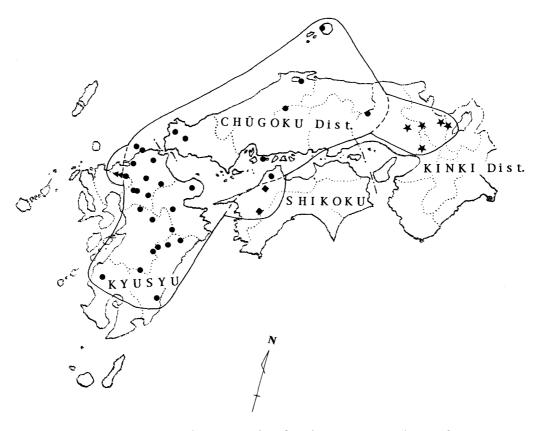


Fig. 5. Distribution map of four subspecies of *Pselaphogenius paradoxus*. Stars indicate collecting sites of *P. p. paradoxus* K. Sawada; circles indicate those of *P. p. magnioculatus* K. Sawada; squares indicate those of *P. p. iyonis* subsp. nov.; triangles indicate those of *P. p. chiyokoae* subsp. nov.

The well differentiated variant described as a subspecies in this study occurs in a relatively small area located at the peripheral parts of the distributional range. In the wide range of *P. p. magnioculatus*, the genitalic structure varies remarkably, though the morphological variation is continuous comparing with that between subspecies.

As the result of the survey and examination shown above, the possible speciation process of *P. paradoxus* is concluded as follows: 1) *P. paradoxus* was spaciated from a *Pselaphogenius* species complex somewhere in/nearby the present distributional range. 2) Its distributional range extended into the wide area surrounding the Setonaikai Sea when the sea level was lower than it is now and Honshu, Shikoku and Kyushu were connected with each other in a relatively cool period. At this time, the range might have overlapped those of the other species. 3) The distributional range was divided and separated because of transgression at a relatively warm time. 4) The allopatric speciation at the subspecies level occurred in small isolated areas at the peripheral parts of the distributional range.

#### 要 約

日本産アラメヒゲナガアリヅカムシ属 Pselaphogenius に関する分類学的再検討の第2部として、サイゴクヒゲナガアリヅカムシ (和名新称) P. paradoxus K. Sawada を検討した。本種は京都府および大阪府から記載された基亜種のほかに、山口県秋吉台から別種として記載された P. p. magnioculatus K. Sawada (亜種に格下げ)、愛媛県から採集された P. p. iyonis (新亜種)、および佐賀、福岡両県境に位置する脊振山地西部に産する P. p. chiyokoae (新亜種) の合計 4 亜種からなると認められた。このうち 3 亜種の分布範囲は比較的狭く、瀬戸内海を取り囲む広い範囲に分布する亜種 magnioculatus の分布域の周縁部に位置している。

#### References

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Nomura, S., 1999. A taxonomic revision of the Japanese species of the genus *Pselaphogenius* (Coleoptera, Staphylinidae, Pselaphinae) Part 1, Species from Western Kyushu. *Bull. natn. Sci. Mus., Tokyo*, Ser. A, 25: 259–268. See Nomura (1998) and the first part of this study for the other references.